International Journal of Nanotechnology and Application (IJNA)
ISSN(P): 2277-4777; ISSN(E): 2278-9391
Vol. 3, Issue 5, Dec 2013, 21-26

PREPARATION OF NANO-SILVER PARTICLES BY CHEMICAL METHOD FOR ANTI-BACTERIA'S APPLICATIONS

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ABSTRACT

In this search , Nano-silver particles were prepared by chemical method(reduction method), the homogenous nano silver particles with size average (58.82 nm) were obtained from this method, different molar concentrations of reactive materials were used, the optimum molar concentration give this size average, Stable Ag Nano particles were prepared, their shapes and size distribution characterized by particle characterizer and scanning electron microscopic (SEM), and force electron microscopic (AFM) are used, the (DLS) **Zetazaser** tool was used to calculate of Zeta Potential and (PDI) of resulting nanoparticles , these results were showed by figure (3a,b), AFM and SEM pictures were showed in figure (4,5),The antimicrobial activity of Ag nanoparticles was investigated against yeast , the bio bacterial activity was showed these nanoparticles were very active to (E colie) bacteria.

KEYWORDS: Silver Nanoparticles, Reduction Chemical Method, Bioactivity

INTRODUCTION

In recent years noble metal nanoparticles have been the subjects of focused researches due to their unique electronic, optical, mechanical, magnetic and chemical properties that were significantly different from those of bulk materials [1,2]. These special and unique properties could be attributed to their small sizes and large specific surface area. For these reasons metallic nanoparticles have found uses in many applications at deferent fields as catalysis, electronics, and photonics. A variety of preparation routes have been reported for the preparation of metallic nanoparticles [3]; The using of silver nanoparticles as antibacterial agent is relatively new. Because of their high reactivity due to the large surface to volume ratio, nanoparticles play a important role in inhibiting bacterial growth in aqueous and solid media. Silver containing materials can be employed to eliminate microorganisms on textile fabrics [4,5] or they can be used for water treatment [6]. A variety of preparation routes have been reported for the preparation of metallic nanoparticles [3,7]; notable examples include, reverse micelles process [8,9], salt reduction [1,10], microwave dielectric heating reduction [11], ultrasonic irradiation [12], radiolysis [13,14], solvothermal synthesis [15], electrochemical synthesis [16,17], etc.

The simplest and the most commonly used bulk-solution synthetic method for metal nanoparticles was the chemical reduction of metal salts [18,19]. In fact, production of Nano-sized metal silver particles with different morphologies and sizes [20] by using chemical reduction of silver salts has been reported [21]. This synthetic method involves reduction of an ionic salt in an appropriate medium in the presence of surfactant using various reducing agents [22].

Zeta potential is a physical property which was exhibited by any particle in suspension. It can be used to optimize the formulations of suspensions and emulsions. Knowledge of the zeta potential can reduce the time needed to produce trial formulations. It is also an aid in predicting long-term stability.[23]

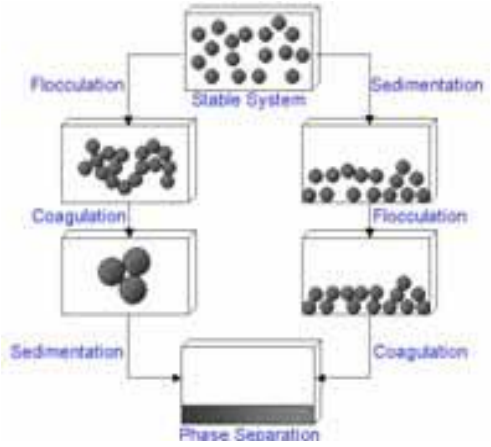


Figure 1: Schematic Diagram Showing Various Mechanisms where Stability May Be Lost in a Colloidal Dispersion [23]

EXPERIMENTAL

Material and Methods

Silver nitrate ($AgNO_3$) Hydrazine hydrate, Citrate of sodium and Sodium Dodecyl Sulphate (SDS) were purchase from Merck Peruana. All chemicals were used as received. Double-distilled deionized water was used.

Characterization Technique

DLS, ZETAZIZER was used to measure of zeta potential, size average and (PDI) of resulting nanoparticles, AFM and SEM microscopy to measure of morphology of silver nanoparticles were used.

Preparation of Silver Nanoparticles

For the preparation of silver nanoparticles two stabilizing agents, Sodium Dodecyl Sulphate (SDS) and Citrate of sodium were used. For the synthesis of silver nanoparticles, silver nitrate solution (different mil molar are used2mM – 10 mM with constant increasing 4 mM) and 8% (w/w) Sodium Dodecyl Sulphate (SDS) were used as a metal salt precursor and a stabilizing agent, respectively. The transparent colorless solution was converted to the characteristic pale yellow and black, when citrate of sodium was used as stabilizing agent. The occurrence of color was indicated the formation of silver nanoparticles. The silver nanoparticles were purified by centrifugation. To remove excess silver ions, the silver colloids were washed at least three times with deionized water under nitrogen stream. A dried powder of the Nano size silver was obtained by freeze-drying. To carry out all characterization methods and interaction of the silver nanoparticles with bacteria, the silver nanoparticle powder in the freeze-drying cuvette was re-suspended in deionized water; the suspension was homogenized with a Fisher Bioblock Scientific ultrasonic cleaning container.

Figure 2: Show the Colours of Resulting Silver Nanoparticles at Steps of Preparations

MEASUREMENTS, RESULTS AND DISCUSSIONS

The results of (DLS) ZETASIZER showed we obtained on very homogeneous Nano silver with average size (58.82) nm, except one peak , this peak refers to 62 nm average size, this prove the homogenous of resulting nanoparticles.

As well as the (DLS) results refer to obtain Nano silver particles with very small of zeta potentials (-35.5) this refers to polydispersity of nanoparticles is very high this refers to stability of nanoparticles to long time with out any reaction and bonded between them , this also proved by (PDI) which is (0.055), is very small and very near to zero value, this refer also to high stability and homogenous of resulting Nano silver as in figure(3),this results for optimum concentration of sodium strait (10mM

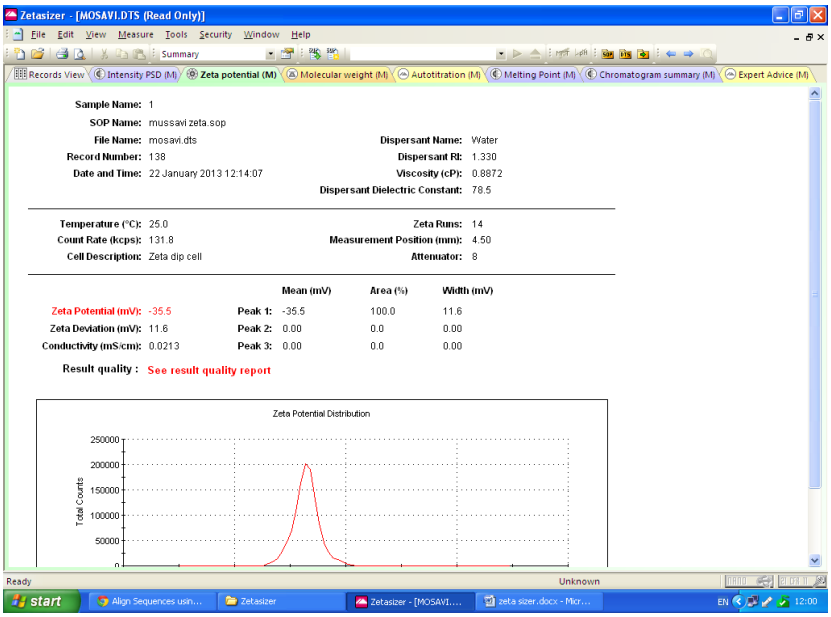


Figure 3(a): Zeta Potential of Nano Silver

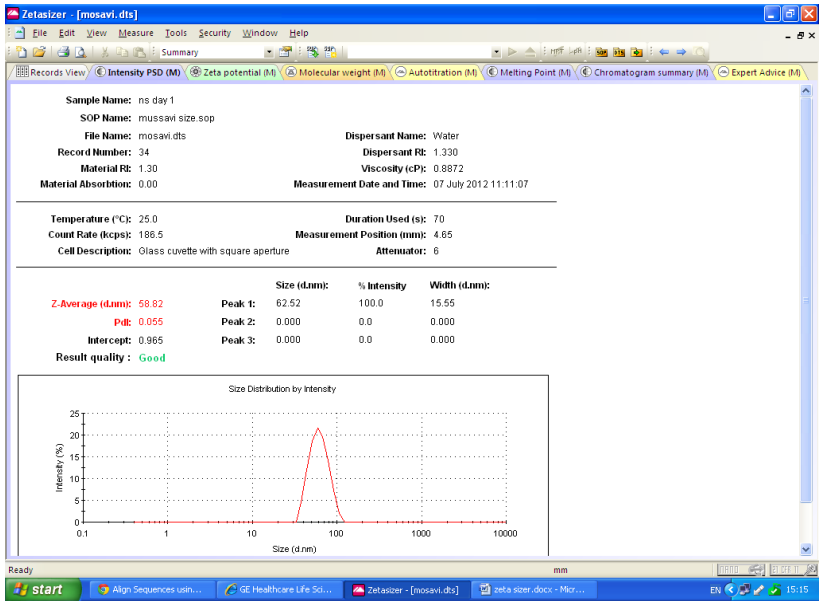


Figure 3(b): Size Average of Nano Silver Particle

Figure 3(a,b): Showing the (DLS) ZETASIZER Results of Nano Silver Particles

Figure 4 showed the SEM picture of resulting Nano silver

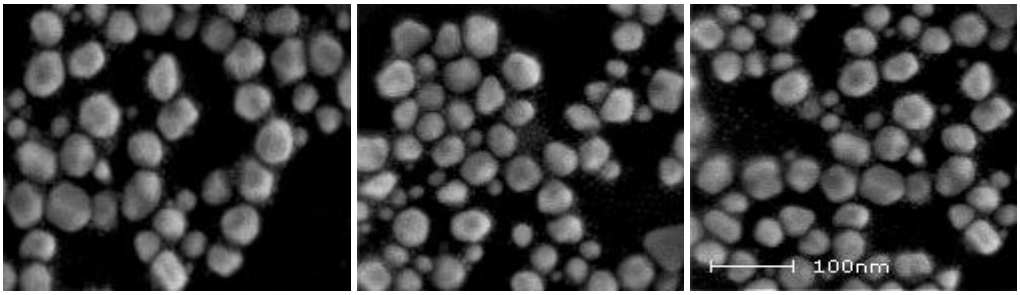
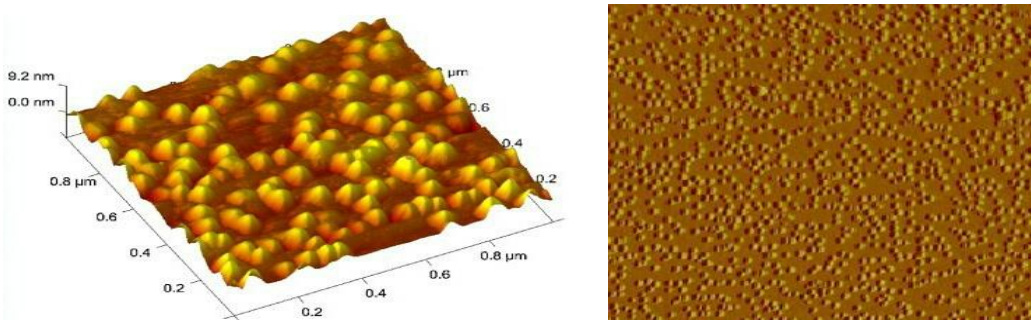


Figure 4: Showing the SEM Pictures of Resulting Nano silver,

(a) 2mM con.% of Sodium Strait (S.S), (b) 6 mm con% of (S.S), (c) 10 mM con% of (S.S)

Figure 5 (a,b) show the AFM pictures of resulting Nano silver(10 mm)



(a) **(b)**

Figure 5(a,b): Showing the AFM Pictures of Resulting Nano Silver (1:20 mM)

Antimicrobial activity was measured according to ***Escherichia coli*** by the Kirby-Bauer diffusion method which was used as antimicrobial susceptibility testing method, 10^5 CFU/ml from concentration of bacteria were used for the tests., Zones of inhibition were measured after (12 & 24) hr of incubation at 35℃. The comparative stability of discs containing oxacillin and ciprofloxacin was made, as in figure 6 (a&b), we show the inhabitation of Nano silver increase with increasing of time. The optimum concentration of Nano silver is 10^{-2} wt%.

(a) After 12Hr **(b) After 24Hr**

Figure 6: Showing the Antibacterial Activity of Nano Silver (a) After 12 Hr (b) After 24 Hr. to *E. coli*

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